Chapter 2: Alternatives

This chapter presents and describes the alternatives considered for meeting the purpose of and need for the Southern Corridor. In accordance with guidelines provided in FHWA's Technical Advisory T6640.8A, the No-Build and build alternatives were considered. Section 2.1, Summary of the Alternative Development Process, presents ways to meet the need for the project. The remainder of the chapter discusses reasonable alternatives for the Southern Corridor and summarizes the detailed evaluations of these alternatives.

2.1 Summary of the Alternative Development Process

Under the alternative development process, both non-highway and highway build alternatives were reviewed, as described below. The options were evaluated to determine whether they met the purpose and need of the project and were evaluated according to other criteria including operational features, cost, constructibility, safety, capacity, geography, demographics, and environmental characteristics.

2.1.1 Non-highway Alternatives

2.1.1.1 Arterial Roads

A review of the existing road network, future land use plans, preferences of the local community, and physical constraints was conducted to determine whether improving the existing arterial system could meet the project purpose and need. As noted in Section 1.2, Existing Transportation System Linkage, the existing arterial system consists of discontinuous roadways that serve short local trips rather than long through trips (see Figure 1-2, Regional and Local Roadways).

The review determined that an improved arterial system would not meet the purpose and need based on the following reasons:

- An improved arterial system would not meet the primary purpose of providing a single regional transportation facility between St. George, Washington City, and Hurricane. The expanded arterial system would also not be compatible with the local cities' and the county's land use plans for a regional transportation facility, or with the preferences of the local communities (see Section 1.1.3.2, Local Planning Studies and General Plans).

- The existing system of arterial streets cannot be extended to accommodate additional demand because of geographic constraints such as the Virgin River and topographic limitations such as White Dome, Washington Dome, and Middleton Black Ridge (see Figure 1-3, Natural Constraints). Future roads would be aligned around these natural features, creating narrow corridors that would increase traffic congestion.

Because of topographic limitations, the arterial system would have limited access points to I-15, St. George, and Washington City, restricting arterial roads in this area to the current roadway network operating near capacity.

- There are limited opportunities to widen existing arterials immediately south and east of I-15 because of the amount of and proximity to adjacent development.
- An arterial system with intersections and numerous access points would not function as a regional through facility and would increase delays and air emissions by reducing travel speed.

In summary, an arterial system could be developed to provide access to planned development, but such a system could not function as an alternate regional facility between St. George, Washington City, and Hurricane. In addition, an arterial system would not reduce traffic congestion in the area south and east of 1-15, where development is planned. However, as part of the No-Build Alternative, an arterial system has been developed.

2.1.1.2 Transportation Management Strategies

Transportation management strategies (TMS) increase the person-capacity of a transportation system without adding pavement or travel lanes, and include alternative options such as fringe parking, ride sharing, and high-occupancy vehicle lanes on existing roadways. St. George has been working and will continue to work with UDOT to implement TMS to improve the signal system, reducing driver delays at intersections. TMS will be an integral part of the MPO's future transportation planning. TMS are included with all of the alternatives.

TMS alone cannot address the primary purpose and need for a proposed regional facility. TMS will ease traffic on I-15 and SR 9 and other major arterial roads, but they cannot meet the demand or substantially improve mobility in the area, which is hampered by the physical layout of the roadways. As described in Chapter 1, Purpose of and Need for Action, the roadway network south and east of I-15 is characterized by disjointed two-lane roadways, which results in

congestion and operating inefficiencies. Because TMS are not designed to address this type of problem, they cannot offer a complete solution.

2.1.1.3 Mass Transit

Mass transit includes reasonable and feasible transit options such as bus service and rail systems. A key component of transit usage is the density of development required to make transit use practical. An analysis of data regarding transit use in relationship to housing density was conducted using six metropolitan areas ranging in population from 531,000 to 16,300,000 (Pushkarev and Zupan 1977). This study was used to determine the viability of mass transit in the Southern Corridor project area.

The study concluded that housing densities of 2 to 7 dwellings per acre produced only marginal use of public transportation. Densities of 7 to 30 dwellings per acre were necessary to sustain transit use in the range of 5 to 40%.

This study also determined what transit modes would work best based on the dwelling unit densities. The study concluded that local bus service would work with densities of 4 to 7 dwellings per acre, but rail service would require a minimum of 9 dwellings per acre. The rail service would further require a downtown area of 35 to 50 million square feet in a metropolitan area of more than 750,000 people with a large workday peak trip to the downtown area.

Bus Systems. The project area has an operating bus service system. The Dixie Area Rapid Transit System is the only mass transit currently in the area. The service in 2001 was limited to four routes with no express routes. As the population in the area grows, bus service will expand to meet increased transit demand.

However, bus service with an expanded arterial road network will not meet the demand for future developed areas and would not meet the main purpose of providing a regional transportation facility between St. George, Washington City, and Hurricane. Additional planning for transit service, including identifying a funding source and a permanent operating agency, will be conducted by the MPO.

Rail Transit. Although rail transit could provide access to planned development, the expected population density of the area could not support a rail transit system. As noted above, high-capacity rail transit, including light rail, is generally not feasible until residential densities reach at least 9 dwellings per acre.

The Washington County Water Conservancy District (WCWCD) prepared the *Population Management Study for Washington County, Utah, 1994*. This study identified unconstrained, undeveloped areas in Washington County that are available for future development. The study also projected future populations based on three growth scenarios using the 1990 U.S. census as a baseline.

One scenario used high levels of growth and dense land use patterns for the undeveloped areas surrounding existing municipalities. Using this scenario, the area does not have the residential density of 9 dwellings per acre required to make rail transit feasible. The average for high-density, multiple-family residential zones was estimated at 18.2 persons per acre. This number was divided by an average household size of 2.61 people per dwelling to obtain a residential density of 7 dwellings per acre. Additionally, the high-density residential zone in this scenario was assumed to cover over one-third of the total undeveloped land.

This number is close to 9 dwellings per acre, the threshold necessary to investigate rail transit feasibility. However, the WCWCD study may have overestimated future populations. As an example, this scenario's results projected St. George's population in 2020 as 165,303 people. In comparison, the City of St. George believes that a population of 147,990 by 2030 is more reasonable, based on the 2000 U.S. census. For more information, see Section 1.5.1, Population Growth. Although some of the dwelling units per acre in the St. George area may by 2030 be close to those in Salt Lake City where a current light rail system is operating, the St. George area will not have the overall population size or centralized business district of Salt Lake City.

The likelihood of implementing a rail transit system in the project area is further reduced by the lack of a centralized business district with the required square footage noted above and the required population base of 750,000 to commute to the downtown area. The reasons for the decentralized population in the project area are the high percentage of retirees compared to other cities and the area's service-oriented economy.

2.1.1.4 Conclusion

The review of arterial roads and mass transit showed that neither of these options meets the need of the project, either individually or combined. Therefore, they have been eliminated from detailed study under the proposed action.

2.1.2 Highway Alternatives

To determine whether an alternative would meet the purpose and need, traffic modeling was conducted as noted in Chapter 1, Purpose of and Need for Action. To meet the purpose and need, an alternative must provide a regional transportation facility between St. George, Washington City, and Hurricane, reduce some traffic on the existing and future network of arterial and city streets, improve traffic conditions in areas already developed, and accommodate areas of planned future growth. The alternative must be compatible with local and regional transportation and land use plans.

Planned Growth Areas. As discussed in Chapter 1, Purpose of and Need for Action, growth in the region is expected to continue through the 2030 planning period. Discussions with planning and resource agencies have indicated that growth will occur to the south and east of 1-15, since the area north of I-15 has been developed within the limits of the topography and the 61,022-acre Red Cliffs Desert Reserve.

The Red Cliffs Desert Reserve was established to protect the desert tortoise and other sensitive animal and plant species from future growth. The reserve, which was established as part of a Habitat Conservation Plan, provides a mechanism for orderly growth and development in Washington County without further jeopardizing the status of federally listed or special-status species.

A network of arterial roads to accommodate access to planned growth has not been sufficiently developed south and east of I-15. The anticipated growth in this area is indicated by the submission of plans to the local planning agencies for the Outlaw Ridge, Dixie Springs, Red Hawk, and Leucadia developments (see Figure 1-4, Future Developments). Additionally, several industrial developments are currently planned south of I-15. As these developments are implemented, access will need to be provided and the existing system of arterial roads expanded to meet the expected growth. However, these roads cannot be expanded sufficiently to meet future intraregional demand (see Section 2.1.1, Non-highway Alternatives).

Future Traffic Volumes. Table 2.1-1, 2030 LOS, No-Build and Build Alternatives, shows the modeling results for the 2030 planning period including the Southern Corridor. Results of the modeling demonstrate that a new highway would reduce some traffic on the network of arterial and local streets; this network would otherwise be operating at or over capacity. The modeling results were based on a total regional population of 208,641 as shown in Table 1.5-1, 1994–2030 Population and Dwelling Unit Growth Rates. For an explanation of LOS, see Section 1.3.1, Level of Service.

The 2030 modeling results from the QRSII model show that many roads would operate over capacity. This occurs because QRSII assigns traffic to the shortest route until capacity is reached, then assigns traffic to the next available route, which results in both routes' operating above capacity. QRSII continues to assign traffic to the roadways in the network in this manner, regardless of their being over capacity, to satisfy the trip generation and destinations defined by the socioeconomic inputs for the model. It is expected that, as traffic increases in the area, the local governments would implement roadway improvements to minimize congestion.

Table 2.1-1. 2030 LOS, No-Build and Build Alternatives

Segment	Number of Lanes	Capacity for LOS E (ADT)	No-Build		3400 West (Alternative A)			2800 West (Alternative D)			4300 West (Alternative E)		
			Volume (ADT)	LOS	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build
SR 9 Segments													
SR 9 at 4400 W. (West Leg)	5	39,000	59,398	F	50,435	F	Decreased	49,392	F	Decreased	52,041	F	Decreased
SR 9 at 1760 W. (East Leg)	5	39,000	35,533	E	42,527	F	Increased	39,823	F	Increased	41,778	F	Increased
Brigham Road Segments													
Brigham Rd. (I-15 to Frontage Rd.)	3	16,500	26,020	F	24,833	F	Decreased	26,843	F	Increased	24,903	F	Decreased
Brigham Rd. at Node 45 (interchange between Frontage Rd. and River Rd., West Leg)	3	16,500	40,621	F	22,674	F	Decreased	24,791	F	Decreased	22,518	F	Decreased
Brigham Rd. at River Rd. (West Leg)	3	16,500	23,529	F	14,321	E	Decreased	19,906	F	Decreased	14,132	E	Decreased
I-15 Segments (Existing Cross-Section)													
I-15 NB (Atkinville to Brigham)	2	44,500	19,369	A-C	39,142	E	Increased	40,038	E	Increased	38,974	E	Increased
I-15 SB (Atkinville to Brigham)	2	44,500	19,369	A-C	36,702	E	Increased	35,716	E	Increased	36,446	E	Increased
I-15 NB (Brigham to Bluff)	2	44,500	36,880	E	48,332	F	Increased	49,249	F	Increased	48,083	F	Increased
I-15 SB (Brigham to Bluff)	2	44,500	34,052	D	50,260	F	Increased	50,573	F	Increased	49,851	F	Increased
I-15 NB (Bluff to St. George Blvd.)	2	44,500	36,428	E	41,539	E	Increased	42,610	E	Increased	41,398	E	Increased
I-15 SB (Bluff to St. George Blvd.)	2	44,500	36,316	E	41,565	E	Increased	42,038	E	Increased	41,347	E	Increased
I-15 NB (Blvd. to Green Springs)	2	44,500	43,394	E	42,603	E	Decreased	42,954	E	Decreased	42,546	E	Decreased
I-15 SB (Blvd. to Green Springs)	2	44,500	49,876	F	47,165	F	Decreased	46,984	F	Decreased	47,128	F	Decreased
I-15 NB (Green Springs to RP 13)	2	44,500	43,987	E	41,702	E	Decreased	41,593	E	Decreased	41,507	E	Decreased
I-15 SB (Green Springs to RP 13)	2	44,500	45,585	F	40,204	E	Decreased	39,755	E	Decreased	40,042	E	Decreased
I-15 NB (RP 13 to SR 9)	2	44,500	44,018	E	40,778	E	Decreased	41,262	E	Decreased	40,502	E	Decreased
I-15 SB (RP 13 to SR 9)	2	44,500	42,706	E	39,694	E	Decreased	39,263	E	Decreased	39,527	E	Decreased

Segment	Number of Lanes	Capacity for LOS E (ADT)	No-Build		3400 West (Alternative A)			2800 West (Alternative D)			4300 West (Alternative E)		
			Volume (ADT)	LOS	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build
River Road Segments													
River Rd. at Brigham Rd. (North Leg)	3	15,000	30,131	F	24,630	F	Decreased	20,879	F	Decreased	19,154	F	Decreased
River Rd. at Brigham Rd. (South Leg)	3	15,000	46,012	F	24,630	F	Decreased	29,048	F	Decreased	24,501	F	Decreased
River Rd. at 2450 S. (North Leg)	3	15,000	27,602	F	22,340	F	Decreased	22,405	F	Decreased	22,381	F	Decreased
River Rd. at Riverside (South Leg)	5	39,000	61,351	F	60,564	F	Decreased	61,318	F	Decreased	60,334	F	Decreased
River Rd. at 100 S. (South Leg)	5	39,000	27,869	D	27,502	D	Decreased	28,530	E	Increased	27,452	D	Decreased
2450 South Segments													
2450 S. at River Rd. (East Leg)	3	15,000	22,556	F	17,634	F	Decreased	17,463	F	Decreased	17,602	F	Decreased
2450 S. at Little Valley (West Leg)	3	15,000	20,236	F	10,644	D	Decreased	10,208	D	Decreased	10,669	D	Decreased
Various Segments													
RP 13 Connector (Telegraph Rd. to I-15)	5	39,000	9,964	A-C	6,293	A-C	Decreased	6,488	A-C	Decreased	6,258	A-C	Decreased
Telegraph Rd. at Main St. (West Leg)	5	39,000	14,533	A-C	13,795	A-C	Decreased	13,526	A-C	Decreased	13,710	A-C	Decreased
Industrial Rd. (Washington Fields to Telegraph Rd.)	3	15,000	9,052	D	5,152	A-C	Decreased	5,292	A-C	Decreased	4,829	A-C	Decreased
Little Valley at 2450 South (South Leg)	3	15,000	18,933	F	5,316	A-C	Decreased	5,665	A-C	Decreased	5,302	A-C	Decreased
3000 East at 1450 South (South Leg)	3	15,000	17,342	F	9,903	A-C	Decreased	10,007	D	Decreased	9,971	A-C	Decreased
2450 East (Riverside to 2000 S.)	3	15,000	20,570	F	16,861	F	Decreased	17,320	F	Decreased	16,648	F	Decreased
Washington Dam at Washington Fields (East Leg)	3	15,000	12,208	E	5,945	A-C	Decreased	5,500	A-C	Decreased	5,636	A-C	Decreased
Pineview at Industrial Rd. (North Leg)	3	15,000	10,314	D	7,782	A-C	Decreased	8,154	A-C	Decreased	7,529	A-C	Decreased
Washington Fields at Industrial Rd. (South Leg)	5	39,000	14,679	A-C	10,323	A-C	Decreased	10,051	A-C	Decreased	9,680	A-C	Decreased

Segment	Number of Lanes	Capacity for LOS E (ADT)	No-Build		3400 West (Alternative A)			2800 West (Alternative D)			4300 West (Alternative E)		
			Volume (ADT)	LOS	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build	Volume (ADT)	LOS	Volume Compared to No-Build
Southern Corridor Segments													
All Build Alternatives													
South Belt, I-15 to 1st Interchange	4	89,000			60,713	D		59,278	C		60,268	D	
South Belt, 1st Interchange to River Rd.	4	89,000			32,020	A-C		28,618	A-C		31,873	A-C	
South Belt, River Rd. to Fort Pearce	4	89,000			29,236	A-C		24,165	A-C		29,211	A-C	
South Belt, Fort Pearce to Airport #1	4	89,000			28,481	A-C		25,510	A-C		28,622	A-C	
South Belt, Airport #1 to Airport #2	4	89,000			18,071	A-C		15,642	A-C		18,276	A-C	
South Belt, Airport #2 to Red Hawk	4	89,000			20,678	A-C		18,122	A-C		20,930	A-C	
South Belt, Red Hawk to Washington Dam	4	89,000			29,443	A-C		23,893	A-C		29,411	A-C	
South Belt, Washington Dam to 5400 W.	4	89,000			31,225	A-C		25,099	A-C		30,993	A-C	
3400 West Alternative (A)													
South Belt, 5400 W. to 4000 W.	4	89,000			28,481	A-C							
South Belt, 4000 W. to 2000 S.	4	89,000			27,917	A-C							
South Belt, 2000 S. to SR 9	4	89,000			39,403	A-C							
2800 West Alternative (D)													
South Belt, 5400 W. to 3000 S.	4	89,000						20,015	A-C				
South Belt, 3000 S. to SR 9	4	89,000						19,293	A-C				
4300 West Alternative (E)													
5400 W. to 2000 S.	4	89,000									30,470	A-C	
2000 S. to SR 9	4	89,000									31,445	A-C	

With the addition of the Southern Corridor, the output from the travel demand model indicates some traffic volume decrease on the local arterial and collector roadways, improving access to and increasing traffic on I-15. This increase in traffic on I-15 is due to traffic using the I-15 Atkinville interchange via the Southern Corridor instead of the Bloomington interchange via River and Brigham Roads. In other words, the freeway system would absorb regional trips that would otherwise occur, at least in part, on the local arterial system. In addition, traffic on SR 9 would increase at the connection point with the Southern Corridor. The increase in traffic may require expansion of I-15 from Brigham Road to Bluff Street to six lanes and SR 9 at some locations to seven lanes.

Several facilities would have improved volume-to-capacity ratios with the addition of the Southern Corridor, although planned improvements for these facilities may not be sufficient. The analysis shows that while operations would improve, some arterial roadways would remain at LOS E or F with the addition of the Southern Corridor. Although the Southern Corridor does reduce some congestion, its primary purpose is to provide a regional transportation facility between St. George, Washington City, and Hurricane, with a secondary purpose of reducing congestion on some existing arterial roads.

Interviews with local planning officials indicated that the transportation improvement plans generally have a planning year of 2020, while the planning horizon for this study is 2030. The officials noted that all anticipated projects identified to occur between 2020 and 2030 are already in the 2020 long-range plan. The results of this modeling effort may help update those long-range plans.

Based on the model outcome for the 2030 No-Build and build alternatives, operations at the following locations are anticipated to improve (see Figure 2-1):

- I-15 Bloomington interchange (RP 4)
- Brigham Road and River Road intersection
- Brigham Road between I-15 and River Road
- River Road from the current south terminus to 100 South
- River Road and 1450 South intersection
- River Road and Riverside Drive intersection
- Little Valley Road south of 2450 South
- 2450 South from River Road to 3000 East
- 2450 East south of Riverside Drive
- Pineview from Telegraph Road to Industrial Road
- SR 9 from 4400 West to I-15
- Industrial Road from Washington Fields Road to Telegraph Road
- Washington Fields Road south of Industrial Road
- Washington Dam Road east of Washington Fields Road

The 2030 ADT on the Southern Corridor varies according to the build alternative and the location along the corridor. The Southern Corridor would help alleviate some congestion in many areas of the region by diverting traffic from limited local arterial roads such as River Road, Brigham Road, Little Valley Road, Fort Pearce Road, and Riverside Drive.

Travel Time and Cost. Using the future traffic volumes predicted by the QRSII model, a comparison of the No-Build and build alternatives was made to determine the cost savings, if any, to travelers if the Southern Corridor is built. QRSII supplies vehicle-hours traveled (VHT) in the network on the average weekday. Comparing the network VHT for each build alternative versus the No-Build Alternative gives an indication of the relative time savings associated with each alternative. Land use planning that has occurred in the project area and incorporates mixed-use development was included in the analysis for all alternatives. The mixed-use land use projections result in reduced trips and/or trip lengths since many goods and services are located next to residential areas.

Road user unit costs vary by location and vehicle type. Passenger cars typically have the lowest hourly cost, with single-unit trucks and semitrailer trucks being slightly higher. Unit costs by category range from $9 to $12 per hour for passenger cars, $15 to $20 per hour for light trucks, and $25 to $30 per hour for heavy trucks (Texas Transportation Institute 1999). These costs were obtained through surveys of several states, not including Utah. Hourly road user costs in Utah have not been studied.

For this planning-level analysis, an average road user cost per vehicle of $10 per hour was used for all classes of vehicles, which resulted in a conservative estimate of the road user cost impacts for the Southern Corridor. These results, summarized in Table 2.1-2, show that travel costs under the build alternatives would be reduced compared to the No-Build Alternative.

Table 2.1-2. User Cost Summary by Alternative, 2030

Alternative	Weekday Daily Vehicle-Hours Traveled (Entire Network)	Number of Weekday Daily Hours less than No-Build	Weekday Daily Road User Cost (Entire Network)	Weekday Daily Cost Savings over No-Build[a]	Annual Cost Savings over No-Build[b]
No-Build	214,455	—	$2,144,550	—	—
3400 West	198,217	16,238	$1,982,170	$162,380	$50,378,395
2800 West	196,763	17,692	$1,967,630	$176,920	$54,889,430
4300 West	198,810	15,645	$1,988,100	$156,450	$48,538,613

Cost comparison is for comparative purposes only. Cost is savings expected from total road users based on reduced travel time.

[a] Assumes an average vehicle cost per hour of $10.

[b] Assumes that the average daily traffic on the entire network is 85% of the average weekday daily traffic on the entire network.

2.1.2.1 Conclusion

Based on traffic modeling and the anticipated future growth and planned development, a highway alternative would meet the primary purpose of providing a regional transportation facility and would also reduce some traffic on existing and future arterial roads and accommodate future planned developments. Additionally, a highway alternative would improve mobility in the area and reduce travel times, costs, and congestion on the roadways south and east of I-15. Provided below is a discussion of the development of alignments to meet the project need.

2.1.3 Induced Demand and Latent Demand

The terms "latent demand" and "induced demand" are often used interchangeably to mean that the construction of new or improved transportation facilities would encourage additional and/or longer automobile trips. At times these terms also encompass a concept of "sprawl growth" or "induced growth," meaning new growth that has been encouraged by new or improved transportation facilities. Both latent and induced demand are intended to capture vehicle trips that could be generated by the new or improved roadways. Some analysts identify the following three aspects of latent and induced demand:

1. ***Longer Trips.*** The new or improved facility may cause changes in land use, generating trips by allowing people to travel longer distances to their destinations. For example, growth projected in a region may spread farther if there is adequate transportation.
2. ***New Trips.*** A lessening of congestion might change transportation habits, generating new vehicle trips. For example, people might move their homes, jobs, or services to a new area if adequate transportation were to exist.
3. ***Optional Trips.*** Congestion might discourage certain kinds of trips that would be taken if roadways were less congested. For example, people might choose to attend a 7:00 PM movie if rush hour traffic were less congested.

This EIS measures these three categories of potential trips using the latent demand analysis described below.

Latent Demand. When distinguished from induced demand, latent demand refers to additional vehicle trips generated by the projected population growth. These are trips that would be taken by the projected population if there were no impediments to travel, such as roadway congestion. Latent demand measures trips in the population, but only trips that would be taken if improved roadways

exist. Latent demand does not isolate the specific growth or transportation habits that account for additional trips.

Induced Demand. In contrast, induced demand refers to isolating and analyzing the new trips that are attributable to the particular changes in growth resulting from the new or improved roadways. The concept of induced demand distinguishes the contribution of transportation investments from other actions, such as population increases.

Whether used interchangeably or separately, latent and induced demand attempt to measure how highways affect growth. However, the research literature is not consistent on this basic issue.

1999 GAO Study. The U.S. General Accounting Office (GAO) recently studied these growth issues at the request of the U.S. Congress. In April 1999, GAO issued a report, *Community Development: Extent of Federal Influence*, which concluded that the relationship between highway spending and induced growth or sprawl is unclear and complex. Urban growth patterns are accounted for by many demographic and social factors that are unrelated to roadways. The relationships among these factors are so complex that researchers have had great difficulty isolating the impact of any individual factor such as highway spending.

Other reports have concluded that there is a relationship between highways and where growth will occur. A report prepared for the Brookings Institution concluded that highways influence where growth will occur, and the gain in some areas is at the expense of other locations, which may cause decentralization of cities (Boarnet and Haughwout 2000).

The National Cooperative Highway Research Program concluded that in order for a change in transportation to generate a significant shift in land use, the transportation change must affect the accessibility enough to generate a change in the land use. For example, locations near interchanges are made more accessible and some shift in travel patterns occurs. As travelers make more trips to a specific location, development pressure intensifies, which leads to increased land values and competition for the site rises (provided that land use policies allow the change in land uses near the interchange). The magnitude of change in land use depends upon how much accessibility is improved, the relative attractiveness of the location near the interchange, and the real estate market in the region (Parsons Brinckerhoff Quade & Douglas, Inc. 1998).

Quantifying Induced Demand. Recently, several research projects have been conducted to quantify induced demand resulting from highways. These efforts have varied in their approach and results.

Goodwin. Phil Goodwin (1996) presents empirical data on conditions on nine improved roads in the United Kingdom, suggesting that after the first year, traffic was 5.7% higher than forecasted by models for the time after the first year. The analysis did not investigate whether this higher level of traffic was diverted from parallel routes.

Heunue. Kevin Heunue (no date) uses travel time from several sources, including work in the United Kingdom and elsewhere, to show that capacity additions may be related to growth in trips. He states that between 7% and 22% of the growth in the amount of miles traveled may be explained by capacity expansion.

DeCorla-Souza. Patrick DeCorla-Souza and Harry Cohen (1998) use travel time to show that a 10% reduction in time may lead to a 5% increase in vehicle-miles traveled (VMT) in a corridor.

Noland. Robert Noland and William Cowart (2000) relate the growth in travel to the growth in lane-miles of roadway. Noland uses statistics of existing and added lane-miles of many major U.S. cities (at the regional level) to relate to an increase in VMT. His models and equations develop a relationship of a 0.5% to 0.7% increase in VMT for each 1% increase in lane-miles.

Fulton. Lewis Fulton and colleagues (2000) conducted analyses in rural and urban areas in the mid-Atlantic region and found that for each 1% increase in lane-miles, an increase of 0.56% to 0.59% in VMT will result. These results are in areas with low density (fewer than 100 persons per acre). The greatest population density studied was 500 persons per acre, which showed a 0.415% increase in the amount of miles traveled for each 1% increase in lane-miles. Like Washington County, the areas analyzed in this study did not have transit service available.

2.1.3.1 Applicability to Southern Corridor

The above studies reflect the ongoing efforts to develop methodologies to measure induced growth or demand. However, it is important to note that the circumstances in this research literature cannot easily be related to the unique conditions in the Southern Corridor. The unique conditions in the area include I-15's being the only existing, continuous, through roadway throughout the entire length of the corridor and the numerous physical constraints that limit the effectiveness of existing arterial roadways. No similar physical constraints or other characteristics like those in the Southern Corridor are evident in the studies of induced travel, making it difficult to transfer the study results. In addition, the studies reflect the lack of consensus within the discipline on measurement tools.

The QRSII modeling software does assess network VMT and VHT. These values give an indication of the average length of trips for both distance and time. To assess the differences in VMT and VHT for the Southern Corridor, capacity-constrained networks for the No-Build and build alternatives were compared. The results of the comparison are given in Table 2.1-3.

Table 2.1-3. Build versus No-Build VMT, VHT, and Average Speed (Capacity Constrained)

	No-Build Alternative	4300 West Alternative	3400 West Alternative	2800 West Alternative	Average Build Difference (%)
VMT (miles)	4,675,589	5,195,102	5,221,855	5,168,917	11.1
VHT (hours)	214,455	198,810	198,217	196,763	–7.7
Average Speed (mph)	21.8	26.1	26.3	26.3	20.6

Table 2.1-3 shows that the total network VMT for the average of the three build alternatives would increase 11.1% over the No-Build Alternative. This could be interpreted to mean the average trip length would increase (induced) by 11.1%, because the Southern Corridor would allow a higher speed and would have a longer connection between productions and attractions than do the existing arterial streets. The 11.1% increase in VMT is consistent with some of the induced demand studies which show an increase in VMT of between 5% and 22% with increase in capacity. When the QRSII model assigns trips to the roadway network, it does so according to travel time and considers a longer trip with reduced travel time to be more attractive than a shorter trip with longer travel time, evidenced by the accompanying decrease in VHT and increase in average network speed. These two numbers could be interpreted to mean that the average trip length measured in hours decreases 7.7% and that the speed of the average trip increases 20.6%. While the VMT are greater in the three build alternatives, they are at a much greater speed for less time.

Because the relationship of highway investments to growth patterns is a subject of ongoing research and public discussion of transportation improvements, this EIS simply identifies the issues to assist the public and the decision-makers. Construction of Southern Corridor would have some incremental impact on growth patterns and locations and would induce the growth of VMT.

2.1.4 Southern Corridor Alignment Alternatives

2.1.4.1 Initial Screening of Regional Alignments

As part of the initial screening process, potential regional alignment options that would meet the purpose and need were studied. Based on the purpose and need for a proposed facility to operate as a regional facility for traffic between St.

George, Washington City, and Hurricane, to be compatible with local land use plans, and to improve mobility and access to planned development, an alignment was selected south and east of I-15. As addressed above, the area south and east of I-15 is the area where the most growth is expected. This regional alignment was the only option that would meet the need of the project; see Figure 2-2, Regional Alignment.

Roadway Termini. I-15 is the major north-south corridor through Utah. The location of I-15 just north of Atkinville Wash is a logical terminus based on the importance of I-15 to the regional transportation facility. SR 9 is the main connection between I-15, Hurricane, Zion National Park, and access to SR 59. The northern end at SR 9 is also a logical terminus since this is the major east-west corridor through this part of Utah. As defined, the Southern Corridor would be an independent highway that, to be usable, would not require the implementation of other roadway projects.

2.1.4.2 Development of Alignment Alternatives

Alternative roadway alignments were developed within the regional alignment between the roadway termini. Alignment alternatives were developed by gathering and evaluating technical information within the regional alignment. Provided below is a description of the criteria used to evaluate alignment alternatives.

Environmental Resource Considerations

Alignment alternatives were developed in consideration of environmental resources by gathering and evaluating technical information on the location of farmlands, wetlands, floodplains, threatened and endangered species (including habitat), and cultural resources, and by soliciting input from the public and resource agencies during the NEPA process. The alignments were modified where necessary to minimize impacts to sensitive plant habitat, cultural resources, and natural springs.

Engineering Considerations

Preliminary Design. To compare the alignment alternatives, all build alternatives were assumed to be limited-access roadways on a new alignment. The preliminary design standards used for all build alternatives are listed below in Table 2.1-4, Design Standards—Roadway, and Table 2.1-5, Design Standards—Interchanges. The proposed typical section is shown in Figure 2-3, Typical Section.

Table 2.1-4. Design Standards—Roadway

Parameter	Standard
Design Year	2030
Level of Service	D
Access Control	Limited
Terrain	Rolling
Maximum Grade, Mainline	6%
Design Speed, Mainline	70 mph
Lane Width, Mainline	12 feet
Minimum Median Width	60 feet
ROW Width, Mainline[a]	300 feet

[a] See Section 2.2.2, 4300 West Alternative, regarding ROW requirements.

Table 2.1-5. Design Standards—Interchanges

Ramp Type	Design Speed (mph)	Minimum Radius (ft)	Maximum Grade
Directional (at termini)	70	1,850	6%
Diamond:			
Gore	70	1,850	6%
Body	50	820	
Terminal	35	375	

Groundwork. During the review, the topographic features were studied to identify the alignment area that would best minimize construction costs and to identify groundwork such as slope, cut and fill, and drainage.

Relocations. A key consideration was minimizing relocations, defined as residences, businesses, and farmsteads within the ROW. A farmstead is a group of buildings that support farming operations.

Utility Lines. Utility lines include those for power, natural gas, liquid petroleum, and communications.

Section 4(f) and 6(f) Properties. Section 4(f) properties are significant public-owned parks, recreation areas, wildlife refuges, and historic sites. Section 6(f) properties are those purchased with Federal Land and Water Conservation funds. See Chapter 5, Sections 4(f)/6(f) Evaluation, for more information on these properties.

Numerous archaeological sites found along the corridor were determined to be 4(f) properties. These sites were avoided.

Planned Growth. One of the needs for the Southern Corridor is to provide access to expected planned development as the area continues to grow. As part of the planned analysis, developments and city and county land use plans were considered. Some of the developments have been platted and submitted to city and county planning agencies.

2.1.4.3 Alignment Alternatives Evaluated

Southern Corridor Partnering Session. On April 6, 1999, UDOT held a partnering session with federal and state agencies, local county and city officials, and the public to discuss the Southern Corridor and to gather input on potential alignments. The meeting was attended by about 45 people, who were divided into five working groups to develop alignments. Prior to the development of alignments, a map showing environmental constraints such as washes, sensitive species, cultural resources, and geotechnical constraints was shown to the group to consider while developing alternatives. During the meeting, various alignment options were developed and considered, as discussed below.

Alternative Alignments Developed. Based on the results of the meeting and further engineering and environmental constraints, the alignments shown in Table 2.1-6 were developed for further study (also see Figure 2-4, Alignment Alternatives Evaluated). To facilitate the development of alignments, the corridor was divided into two sections: from I-15 to the proposed airport and from the proposed airport to SR 9.

Table 2.1-6. Summary of Considered Alignments

Alignment	Distance by Segment (miles)	Relocations	Traffic Volume (ADT)	4(f) Impacts
1-15 to Airport				
A	10	0	20,015–30,470[a]	0
Modified A	10	0	20,015–30,470[a]	0
B	10.5	0	20,015–30,470[a]	0
Airport to SR 9				
A	11.5	4	39,403	0
C	12.5	2	39,403	0
D	16	1	19,293	0
E	10	1	30,470	0

[a] Traffic volumes at the southern end of the alignment depend on the connection at SR 9 and vary between 20,015 (Alignment D), 28,481 (Alignments A and C), and 30,470 (Alignment E).

2.1.4.4 I-15 to Vicinity of Proposed Airport (Alignments A, Modified A, and B)

Three alignments were identified near the proposed airport, through private lands owned by Leucadia and Klein corporations and public lands administered by BLM, where the corridor bends from east-west to a north-south direction. These options include the original Alignment A, a modified Alignment A (to the east of the original alignment), and Alignment B.

As a result, the original Alignment A was dropped since it passed too close to the airport safety perimeter and was less compatible with development plans for the Klein and Leucadia properties. Alignment B was dismissed because of the out-of-direction travel of about 0.5 mile and the impacts on Leucadia's property. Modified Alignment A was the one most supported by both developments because it best fit the developments' conceptual development plans. None of the three alignments affected utilities or caused relocations.

2.1.4.5 Proposed Airport to SR 9 (Alignments A, C, D, and E)

Four options were considered between the proposed airport and the connection with SR 9: Alignments A, C, D, and E. Alignments A and C provide access to the same development properties and terminate at the same location on SR 9. Review of these two alignments showed that Alignment C was about 1 mile longer in length; required more slope, cut, and fill; and would conflict with the proposed Sand Hollow Reservoir, since the road alignment is within the lake boundary. Based on these facts, Alignment C was eliminated from further study and Alignment A was carried forward for further analysis.

Alignment D would connect to SR 9 farther east than Alignment A and would provide access to the proposed Sand Hollow Reservoir. Although the volume of traffic for Alignment D would be lower than for the other alignments, this alignment would meet the purpose and need of providing a regional facility with access to expected development. Alignment D was also carried forward for analysis.

Alignment E would provide access to the same development properties as Alignments A and C. Alignment E would have the shortest length of all of the proposed alignments and is best suited to minimize impacts to future developments. In addition, Alignment E would require the least amount of groundwork. Alignment E was also carried forward for analysis.

2.1.4.6 Other Alignment Options Considered

After the initial scoping period and public meetings, an additional alignment option was brought forward for the I-15 connection to the Southern Corridor.

Although the alignments developed for the Southern Corridor had been placed to avoid habitat for sensitive plant species, another alignment that would be located to the north of the Holmgren milkvetch habitat was identified (see Figure 2-5, Other Alternative Considered). This alignment was not carried forward for the following reasons:

- The out-of-direction travel for the identified alignment would minimize the primary purpose of the Southern Corridor's use as a regional facility between St. George, Washington City, and Hurricane.
- It would not align with other proposed transportation improvements identified in the St. George Transportation Master Plan, including the Atkinville interchange and associated road south and west of I-15.
- It would not be compatible with the St. George land use plan. The alternative would be located next to existing and planned residential development near I-15. The current proposed Atkinville interchange alignment is undeveloped, allowing the City to plan for appropriate land use around the Southern Corridor. The new alternative would be next to the noncompatible land use of residential development.
- It would take additional ROW that the City and the State Institutional Trust Lands Association (SITLA) have identified for industrial development along River Road, would separate part of the existing and future planned cohesive community, and would create a high-speed transportation facility through or near residential neighborhoods.

2.1.4.7 Alignment Alternatives Conclusion

Based on the above evaluation of alignments, modified Alignment A from I-15 to the airport and Alignments A, D, and E from the airport to SR 9 were carried forward for analysis. For purposes of this analysis, these alignments are the 3400 West Alternative (Alignments A and Modified A), the 2800 West Alternative (Alignments Modified A and D), and the 4300 West Alternative (Alignments Modified A and E).

2.2 Alternatives Considered

To further refine the alternatives after field studies were completed, additional screening of the build alternatives was conducted. The key categories of concern were wetlands, threatened and endangered species, and cultural resources. Each of these resources was reviewed against the alignments, and modifications were made to minimize impacts—for example, avoiding archaeological sites and threatened and endangered species habitat for the bearclaw poppy and Holmgren

milkvetch. In addition, both the 4300 West and 3400 West Alternatives were modified to the west to avoid Willow Springs, a natural wetland in the area that provides important wildlife habitat.

Cost and Implementation of Build Alternatives. For analysis purposes, a preliminary cost estimate for the Southern Corridor was developed and is shown in Table 2.2-1.

Table 2.2-1. Preliminary Southern Corridor Cost Estimate

Description	4300 West Alternative	3400 West Alternative	2800 West Alternative
Right-of-Way	$7,940,000	$9,610,000	$7,480,000[a]
Construction[b]	$153,520,000	$142,030,000	$201,680,000
Total	$161,460,000	$151,640,000	$209,160,000

[a] Although the 2800 West Alternative has the longest ROW, costs are reduced because the Washington County Water Conservancy District would donate parts of the ROW around the Sand Hollow Reservoir. Also, the land along the alignment is not subdivided.

[b] Construction estimates include the Atkinville interchange and the Southern Corridor. Because the exact location and number of interchanges along the Southern Corridor could change, the costs are not included. The expected cost per interchange would be about $10,000,000.

Currently, there are no funds appropriated for acquiring ROW or constructing the Southern Corridor except for the Atkinville interchange at I-15. This interchange is partially funded in the STIP for $8,000,000. Future funding sources for the Southern Corridor may be available from local cities, the State of Utah, and the federal government. The Southern Corridor would likely become a state road.

The Southern Corridor would be constructed in phases based on need. The timing of the construction would depend greatly on when the area begins to develop, which is difficult to forecast. The first phase would likely be constructed by the time the St. George replacement airport is completed in 2008. The road would initially start as a limited access two-lane road from I-15 to the airport. Access to the road would only be at intersections with the ROW fenced. When traffic demand warrants, the highway would be expanded to become a four-lane, limited-access highway with access being provided at interchanges. The second phase would likely be constructed starting at SR 9 and would eventually link to the St. George replacement airport. Construction of this phase would be after 2010 and would also start as a two-lane limited access road. This road would be upgraded to a limited-access highway when traffic demand warrants based on when the area develops.

After approval of the Final EIS, St. George, Washington City, and Hurricane would adopt in their master plans and zoning the preferred alternative to preserve the corridor. Much of the preservation would require coordination between the cities and developers, private landowners, and SITLA. ROW on BLM land

would be preserved until construction is initiated. BLM would transfer the ROW to FHWA. The Southern Corridor could qualify for state corridor preservation funds.

Build Alternative Interchange Locations. Potential interchange locations are provided for each build alternative. The locations are based on discussion with St. George, Washington City, Hurricane, Washington County, developers, and other local agencies. Since the area is not developed, the actual location of the final number and location of interchanges may change based on final growth/development patterns. Therefore, the interchanges in this EIS are preliminary but have been included to provide the public and decision-maker with information on how the highway might develop. The ROW required for each interchange has been included for analysis in this EIS. As the Southern Corridor is developed in the future, appropriate environmental documentation will be conducted to analyze any potential modifications from what is presented in this EIS. UDOT and the local communities would make final approval of interchange locations. See Section 4.1, Land Use Impacts, for potential impacts associated with interchange locations.

2.2.1 No-Build Alternative

The Council on Environmental Quality regulations (CEQ 1981) require that an EIS include a "no-action" (or "no-build") alternative which, in this case, consists of not building the Southern Corridor. The No-Build Alternative would consist of improving and expanding the existing arterial system to meet future growth. The No-Build Alternative would be implemented as part of the cities' future transportation planning to meet the expected growth by providing access to new developments as they are built. The major roadway projects anticipated for the future under the No-Build Alternative are as follows.

Regional Improvements

- Construct new I-15 interchange at RP 13.

Washington City Improvements

- Extend/improve Washington Field Road (five-lane major arterial) from I-15 to replacement airport.
- Widen Telegraph Road to five lanes, I-15 at Green Springs interchange (RP 10) to east of downtown Washington City.
- Widen 300 East (downtown Washington City to RP 13 interchange).

Hurricane Improvements

- Complete 600 North from SR 9 at 3400 West to SR 9 at 600 North.
- Construct 4300 West from SR 9 to Sand Hollow Reservoir access.
- Construct 2800 West from SR 9 to Sand Hollow Reservoir access.
- Construct 3400 West south of SR 9.

St. George Improvements

- Widen River Road to five lanes from Riverside Drive to Arizona border.
- Construct road to south end of replacement airport.
- Realign 1450 South from River Road to 3000 East.
- Widen Riverside Drive from Foremaster to 400 East.
- Widen Bloomington Drive, entire loop.

It is likely that the above roads would also be constructed for the build alternatives. Other minor roads would be built as needed to accommodate development associated with growth in the area. Because many of the developments have not been planned, it is impossible to determine the future locations of these roads. Table 2.2-2 provides a summary of what changes would be required for the major existing road network under the No-Build Alternative compared to the build alternatives.

Table 2.2-2. Comparison of No-Build and Build Alternatives 2030 Road Network

Roadway Segment	No-Build Alternative	Build Alternatives
River Road at Brigham Road	7 lanes	5 lanes
2450 South at Little Valley	5 lanes	3 lanes
Brigham Road at River Road	5 lanes	3 lanes
3000 East at 1450 South	5 lanes	3 lanes
Little Valley at 2450 South	5 lanes	3 lanes
2450 East (Riverside to 2000 S.)	5 lanes	3 lanes
1-15 Green Springs to RP 13	6 lanes	4 lanes
SR 9 at 1760 West	5 lanes	7 lanes
I-15 Brigham to Bluff	4 lanes	6 lanes

In addition to the changes noted above to the existing road network, the No-Build Alternative would require the following changes:

- River Road would be designated a major arterial instead of a minor arterial.
- A new frontage road that would parallel the Southern Corridor in St. George would be developed into a major arterial.
- The Atkinville interchange would not be built.
- A new north-south road west of the St. George replacement airport would be designated a major arterial instead of a minor arterial.
- Both 4300 West and 2800 West in Hurricane would become major arterials instead of minor arterials.

The City of St. George noted that, under the No-Build Alternative, many of the smaller north-south roads that would be developed would need to be widened to carry a larger volume of traffic. Overall, the roadway network under the No-Build Alternative would be similar to the build alternatives except that some of the roadways would need to be widened.

Figure 2-6, No-Build Alternative Roadway Network, and Figure 2-7, Build Alternatives Roadway Network, depict how the road network would develop differently under the No-Build and build alternatives. Because the road network depicted in the figures is not currently planned and has not been fully developed, potential environmental impacts would be considered, as required, once the cities determine the need for the roadway.

2.2.2 4300 West Alternative

The 4300 West Alternative (Alignments Modified A and E) would be a four-lane, limited-access divided highway with a 60-foot-wide median. The ROW width required for the Southern Corridor would be 300 feet. This width is required to provide room for the trail system and to accommodate the cut-and-fill requirements for the highway. Because of the varying terrain of washes and mesas, the highway would require large fill and cuts which would encompass most of the ROW. Additionally, easements would be necessary where cut-and-fill extend beyond the ROW. The Southern Corridor would likely be built in phases, first as a signalized roadway, then into a limited-access highway as traffic increases.

Project Features. As shown in Figure 2-8, Southern Corridor 4300 West, 3400 West, and 2800 West Alternatives, the 4300 West Alternative consists of a new 300-foot-wide corridor. Starting at the I-15 interchange just north of Atkinville

Wash and extending to the intersection of 4300 West with SR 9 in Hurricane, the project is best described in three sections.

- The southern section passes through undeveloped areas south of White Dome along the Utah-Arizona border, intersecting River Road and continuing to Fort Pearce Wash.
- The central section passes east of the St. George replacement airport, parallels Warner Ridge, and heads north towards the Virgin River. Near the future Redhawk subdivision, 4700 East is intersected by the 4300 West Alternative and parallels it from this point before turning west and becoming 2000 South. From this point, the 4300 West Alternative parallels the Dixie-Escalante utility road to the Washington Dam Road.
- The northern section proceeds northeast along the Turf Sod Road and continues north on the west side of the proposed Dixie Springs and Outlaw Ridge subdivisions. The alignment connects to SR 9 at the intersection of 4300 West. At this intersection, SR 9 would need to be relocated farther south to minimize safety concerns with line-of-sight distances.

Based on current land use projections, interchanges could be at the following locations:

- 1-15 at the Atkinville Wash
- About 2 miles southeast of I-15
- River Road
- Leucadia development
- Southwest end of St. George replacement airport
- Northeast end of St. George replacement airport
- Access Road to BLM Warner Valley access road (would require realignment of frontage road)
- Washington Dam Road about 3 miles south of SR 9
- About 2.5 miles south of SR 9
- About 1 mile south of SR 9
- SR 9 at 4300 West

Other underpasses, overpasses, and final interchange locations would be identified as growth continues in the area and access is needed for planned development. Proposed interchanges would require a 400-foot ROW to be constructed. Dry washes must be crossed in a manner that allows for proper drainage. The Fort Pearce Wash structure would be designed such that the crossing would span the riparian area and accommodate hydraulic capacity for the 100-year flood event. The abutments would be outside the riparian area.

Detention basins would be located throughout the project to retain storm water runoff.

Trail. The trail for pedestrians, bicyclists, and equestrians would parallel the Southern Corridor and would be provided for within the ROW. The trail would be dirt and would have access points at the interchanges.

2.2.3 3400 West Alternative

The 3400 West Alternative (Alignment Modified A) would have a typical roadway section similar to that of the 4300 West Alternative and would be an entirely new highway. The trail would be within the same limits and would have the same characteristics as noted above for the 4300 West Alternative.

Project Features. The southern terminus of the 3400 West Alternative, around the St. George replacement airport and along Warner Ridge, would be the same as the 4300 West Alternative (see Figure 2-8, Southern Corridor 4300 West, 3400 West, and 2800 West Alternatives). The northern section proceeds along Turf Sod Road to Willow Springs, then east to Flora Tech Road where it passes through the future planned developments of Dixie Springs and Outlaw Ridge before proceeding north to SR 9 near 3400 West.

Based on current land use projections, interchanges could be at the following locations:

- 1-15 at the Atkinville Wash
- About 2 miles southeast of I-15
- River Road
- Leucadia development
- Southwest end of St. George replacement airport
- Northeast end of St. George replacement airport
- Access Road to BLM Warner Valley access road (would require realignment of frontage road)
- Washington Dam Road
- About 2.5 miles south of SR 9
- About 1 mile south of SR 9

Other underpasses, overpasses, and final interchange locations would be identified as growth continues in the area and access is needed for planned development. Proposed interchanges would require a 400-foot ROW to be constructed. Dry washes must be crossed in a manner that allows for proper drainage. The Fort Pearce Wash structure would be designed such that the crossing would span the riparian area and accommodate hydraulic capacity for the 100-year flood event. The abutments would be outside the riparian area.

Detention basins would be located throughout the project to retain storm water runoff.

Trail. The trail for pedestrians, bicyclists, and equestrians would parallel the Southern Corridor and would be provided for within the ROW. The trail would be dirt and would have access points at the interchanges.

2.2.4 2800 West Alternative

The 2800 West Alternative (Alignments Modified A and D) would have a typical roadway section similar to that of the 4300 West Alternative and would be an entirely new highway. The trail would be within the same limits and would have the same characteristics as noted above for the 4300 West Alternative.

Project Features. The southern terminus of the 2800 West Alternative, near the St. George proposed airport and along Warner Ridge, would be the same as for the 4300 West Alternative (see Figure 2-8, Southern Corridor 4300 West, 3400 West, and 2800 West Alternatives). From this point, the 2800 West Alternative would proceed east around the proposed Sand Hollow Reservoir, then head north and connect to SR 9 at 2800 West.

Based on current land use projections, interchanges could be at the following locations:

- 1-15 at the Atkinville Wash
- About 2 miles southeast of I-15
- River Road
- Leucadia development.
- Southwest end of St. George replacement airport
- Northeast end of St. George replacement airport
- Access Road to BLM Warner Valley access road (would require realignment of frontage road)
- Washington Dam Road
- Southwest of proposed Sand Hollow Reservoir
- Northeast of proposed Sand Hollow Reservoir
- About 2 miles south of SR 9
- About 1 mile south of SR 9

Adjacent to the Sand Hollow Reservoir, underpasses would be provided to allow recreational access between the reservoir and the BLM Sand Mountain Recreation Area. These underpasses would be located in coordination with BLM once recreational plans are developed. Other underpasses, overpasses, and final interchange locations would be identified as growth continues in the project area and access is needed for planned development.

Proposed interchanges would require a 400-foot ROW to be constructed. Dry washes must be crossed in a manner that allows for proper drainage. The Fort Pearce Wash structure would be designed such that the crossing would span the riparian area and accommodate hydraulic capacity for the 100-year flood event. The abutments would be outside the riparian area. Detention basins would be located throughout the project to retain storm water runoff.

Trail. The trail for pedestrians, bicyclists, and equestrians would parallel the Southern Corridor and be provided for within the ROW. The trail would be dirt and would have access points at the interchanges.

2.3 Land Acquired to Date

No ROW has been purchased for the Southern Corridor. However, the Leucadia development has committed ROW for the Southern Corridor.

2.4 Comparison of Impacts

A summary comparison of the environmental impacts for the alternatives for each resource affected over the study period is provided in Table 2.4-1, Comparison of Environmental Impacts. Impacts to the environment are described briefly in the summary and are discussed in detail in Chapter 4, Environmental Consequences. Potential mitigation measures for the impacts are summarized in Section 4.23, Mitigation Summary. Provided below is a summary of the advantages and disadvantages of the alternatives.

Table 2.4-1. Comparison of Environmental Impacts

Resource Category	No-Build Alternative	4300 West Alternative	3400 West Alternative	2800 West Alternative
Land Use	The general land use character in the project area would change from rural to urban. This alternative is not consistent with the Washington City and St. George land use plans. It is consistent with the Hurricane and Washington County land use plans.	The general land use character in the project area would change from rural to urban. Changes in land use could occur faster along the Southern Corridor than under the No-Build Alternative. This alternative is consistent with the Washington City and St. George land use plans. It is not identified in Hurricane and Washington County land use plans. However, Hurricane and County planners support the project.	The general land use character in the project area would change from rural to urban. Changes in land use could occur faster along the Southern Corridor than under the No-Build Alternative. This alternative is consistent with the Washington City and St. George land use plans. It is not identified in Hurricane and Washington County land use plans. However, Hurricane and County planners support the project.	The general land use character in the project area would change from rural to urban. Changes in land use could occur faster along the Southern Corridor than under the No-Build Alternative. This alternative is consistent with the Washington City and St. George land use plans. It is not identified in Hurricane and Washington County land use plans. However, Hurricane and County planners support the project.
Farmland	Development of local roads would likely affect less than 10 acres. No impacts to grazing allotments.	1 acre of unique farmland affected; 257 acres of grazing allotments directly affected. Indirect impacts caused by bisecting allotments.	50 acres of prime farmland affected; 257 acres of grazing allotments directly affected. Indirect impacts caused by bisecting allotments.	No farmland affected; 385 acres of grazing allotments directly affected. Indirect impacts caused by bisecting allotments.
Social Environment	No environmental justice impacts expected. Community cohesion would decrease without a regional transportation facility. The lack of a regional transportation facility would affect travel patterns and accessibility in the project area. Local transportation projects would not affect recreational resources.	No environmental justice impacts. No change in community cohesion. This alternative would improve overall travel patterns and accessibility in the project area. It would affect access to 2 trails and use of 1 recreation site.	No environmental justice impacts. No change in community cohesion. This alternative would improve overall travel patterns and accessibility in the project area. It would affect access to 2 trails and use of 1 recreation site.	No environmental justice impacts. No change in community cohesion. This alternative would improve overall travel patterns and accessibility in the project area. It would affect access to 3 trails, the Sand Mountain Recreation Area, and use of 1 recreation site.
Relocation	No relocations expected.	1 residential relocation.	4 residential relocations.	1 residential relocation.

Resource Category	No-Build Alternative	4300 West Alternative	3400 West Alternative	2800 West Alternative
Economics	Could result in economic impacts by not providing a regional transportation facility to improve mobility between St. George, Washington City, and Hurricane.	This alternative could result in positive economic impacts by improving mobility to the southern part of the study area where growth is expected. The Southern Corridor would result in small bypass impacts to local cities.	This alternative could result in positive economic impacts by improving mobility to the southern part of the study area where growth is expected. The Southern Corridor would result in small bypass impacts to local cities.	This alternative could result in positive economic impacts by improving mobility to the southern part of the study area where growth is expected. The Southern Corridor would result in small bypass impacts to local cities.
Joint Development	No joint development potential.	Southern Corridor pedestrian and bicycle trail would be incorporated into the local trail system. Highway would be jointly coordinated with BLM.	Southern Corridor pedestrian and bicycle trail would be incorporated into the local trail system. Highway would be jointly coordinated with BLM.	Southern Corridor pedestrian and bicycle trail would be incorporated into the local trail system. Highway would be jointly coordinated with BLM.
Consideration Related to Pedestrians and Bicyclists	Southern Corridor trail would not be constructed. Continued increase in the number of pedestrian and bicycle trails.	Southern Corridor trail implemented along with other trails in the project area.	Southern Corridor trail implemented along with other trails in the project area.	Southern Corridor trail implemented along with other trails in the project area.
Air Quality	No change expected in current attainment status. Vehicle-related emissions for PM_{10}, NO_x, and SO_2 would be less than the build alternatives. VOC and CO emissions would be slightly greater than the build alternatives.	National Ambient Air Quality Standards would not be exceeded. Increase in PM_{10}, NO_x, and SO_2 compared to the No-Build Alternative.	National Ambient Air Quality Standards would not be exceeded. Increase in PM_{10}, NO_x, and SO_2 compared to the No-Build Alternative.	National Ambient Air Quality Standards would not be exceeded. Increase in PM_{10}, NO_x, and SO_2 compared to the No-Build Alternative. Lowest overall emissions of the build alternatives.
Noise	Noise levels around local transportation projects would increase. The noise environment in the general project area would change from rural to urban. Noise levels near Warner Ridge would likely remain rural.	Southern Corridor would increase noise levels on adjacent land. The noise environment would change from rural to urban. Noise levels would exceed 65 dBA, or would increase by 10 dBA or more, at all 7 noise-sensitive receptors (residences).	Southern Corridor would increase noise levels on adjacent land. Noise levels would exceed 65 dBA, or would increase by 10 dBA or more, at all 7 noise-sensitive receptors (residences).	Southern Corridor would increase noise levels on adjacent land. Noise levels would exceed 65 dBA, or would increase by 10 dBA or more, at all 7 noise-sensitive receptors (residences).

Resource Category	No-Build Alternative	4300 West Alternative	3400 West Alternative	2800 West Alternative
Water Quality	Implementation of best management practices would minimize surface water quality impacts. Overall, less impervious surface would be required compared to the build alternatives. No impacts to groundwater quality. 15 groundwater wells affected.	Implementation of best management practices would minimize surface water quality impacts. No impacts to groundwater quality. 14 groundwater wells affected.	Implementation of best management practices would minimize surface water quality impacts. No impacts to groundwater quality. 19 groundwater wells affected.	Implementation of best management practices would minimize surface water quality impacts. No impacts to groundwater quality. 8 groundwater wells affected.
Wetlands/Waters of the U.S.	No wetlands affected. Several waters of the U.S. (dry washes) would be crossed.	No wetlands affected. Flows into waters of the U.S. (dry washes) would be controlled to maintain hydraulic capacity.	No wetlands affected. Flows into waters of the U.S. (dry washes) would be controlled to maintain hydraulic capacity.	No wetlands affected. Flows into waters of the U.S. (dry washes) would be controlled to maintain hydraulic capacity.
Water Body Modification and Wildlife	No impacts to water bodies. 400 acres of desert shrub/scrub habitat would be affected by construction. Loss of habitat would result in direct and indirect effects on local wildlife. Potential impacts to golden eagle nest.	No impacts to water bodies. 675 acres of desert shrub/scrub habitat would be affected by construction. Loss of habitat would result in direct and indirect effects on local wildlife.	No impacts to water bodies. 735 acres of desert shrub/scrub habitat would be affected by construction. Loss of habitat would result in direct and indirect effects on local wildlife.	No impacts to water bodies. 928 acres of desert shrub/scrub habitat would be affected by construction. Loss of habitat would result in direct and indirect effects on local wildlife. Golden eagle nest next to ROW could be affected by construction.
Floodplains	No significant encroachment on floodplains.	No significant encroachment on floodplains.	No significant encroachment on floodplains.	No significant encroachment on floodplains.
Threatened and Endangered Species	Likely to adversely impact 3 endangered plant species. Construction of a road at 4300 West could affect bald eagle roost. Potential impact to southwestern willow flycatcher with widening of roads over the Virgin River. This alternative would not provide a barrier to protect the Warner Ridge population of endangered bearclaw poppy from recreation activities.	Likely to adversely impact 3 endangered plant species. Project may affect, but is not likely to adversely affect, two fish species. Bald eagle roost next to ROW could be affected during construction. This alternative would help BLM provide a barrier to protect the Warner Ridge population of endangered bearclaw poppy from recreation activities.	Likely to adversely impact 3 endangered plant species. Project may affect, but is not likely to adversely affect, two fish species. This alternative would help BLM provide a barrier to protect the Warner Ridge population of endangered bearclaw poppy from recreation activities.	Likely to adversely impact 3 endangered plant species. Project may affect, but is not likely to adversely affect, two fish species. This alternative would help BLM provide a barrier to protect the Warner Ridge population of endangered bearclaw poppy from recreation activities.

Resource Category	No-Build Alternative	4300 West Alternative	3400 West Alternative	2800 West Alternative
Historic, Archaeological, and Paleontological Resources	Potential for impacts on up to 8 NRHP archaeological sites and up to 4 paleontological sites.	Impacts on 23 potential NRHP archaeological sites and 4 paleontological sites.	Impacts on 21 potential NRHP archaeological sites and 4 paleontological sites.	Impacts on 20 potential NRHP archaeological sites and 4 paleontological sites.
Hazardous Waste Sites	3 hazardous waste sites potentially affected within or adjacent to local road projects.	5 hazardous waste sites within or adjacent to the ROW would be affected.	5 hazardous waste sites within or adjacent to the ROW would be affected.	3 hazardous waste sites within or adjacent to the ROW would be affected.
Visual Resources	Local transportation projects would reduce the visual environment of the project area.	Southern Corridor would reduce the overall visual environment. Visual impact rating of 1.53.	Southern Corridor would reduce the overall visual environment. Visual impact rating of 1.59.	Southern Corridor would reduce the overall visual environment. Visual impact rating of 1.56.
Section 4(f)/6(f) Properties	None	None	None	None

2.4.1 No-Build

2.4.1.1 Advantages

The major advantage of the No-Build Alternative compared to the build alternatives is that there would be no environmental impacts associated with building the Southern Corridor. However, about 400 acres of new local roadway would likely be required. This construction would still result in less overall impervious surface compared to the build alternatives. The No-Build Alternative would cause fewer impacts to wildlife habitat and cultural resources.

2.4.1.2 Disadvantages

The major disadvantage of the No-Build Alternative is that it would not satisfy the project's purpose and need, which is providing a regional transportation facility between St. George, Washington City, and Hurricane. Other disadvantages of the No-Build Alternative are as follows:

- It would not allow the communities in the area to plan, develop, and manage an efficient transportation system for the anticipated growth in the region.
- It could allow continued impacts to the Warner Ridge population of the endangered Holmgren milkvetch. The build alternatives would provide some protection for this species by limiting access to Warner Ridge.

2.4.2 4300 West

2.4.2.1 Primary Advantages

- Least amount of ROW required
- Along with the 2800 West Alternative, the fewest relocations required
- Along with the 3400 West Alternative, the fewest acres of grazing allotments affected
- Fewest visual impacts
- The least amount of wildlife habitat impacted

2.4.2.2 Primary Disadvantages

- The most cultural resources affected
- Second-most acres of farmland affected (1 acre)
- Second-highest construction cost ($161,460,000)
- Potential impact to bald eagle roost

2.4.3 3400 West

2.4.3.1 Primary Advantages

- Along with the 4300 West Alternative, the fewest acres of grazing allotments affected
- Lowest construction cost ($151,640,000)

2.4.3.2 Primary Disadvantages

- Highest number of farmland acres affected (50 acres)
- Highest number of groundwater wells affected
- Second-highest number of cultural resources affected
- Second-highest amount of wildlife habitat affected
- Greatest visual impacts
- Conflicts with proposed Outlaw Ridge development

2.4.4 2800 West

2.4.4.1 Primary Advantages

- No farmland impacts
- Fewest cultural resources affected
- Fewest hazardous waste sites along the ROW
- Along with 4300 West, the fewest relocations required
- Fewest number of groundwater wells affected

2.4.4.2 Primary Disadvantages

- The most recreational resources affected
- Highest cost ($209,160,000)
- The most acreage of grazing allotments affected
- Highest amount of wildlife habitat affected
- Greatest amount of ROW required

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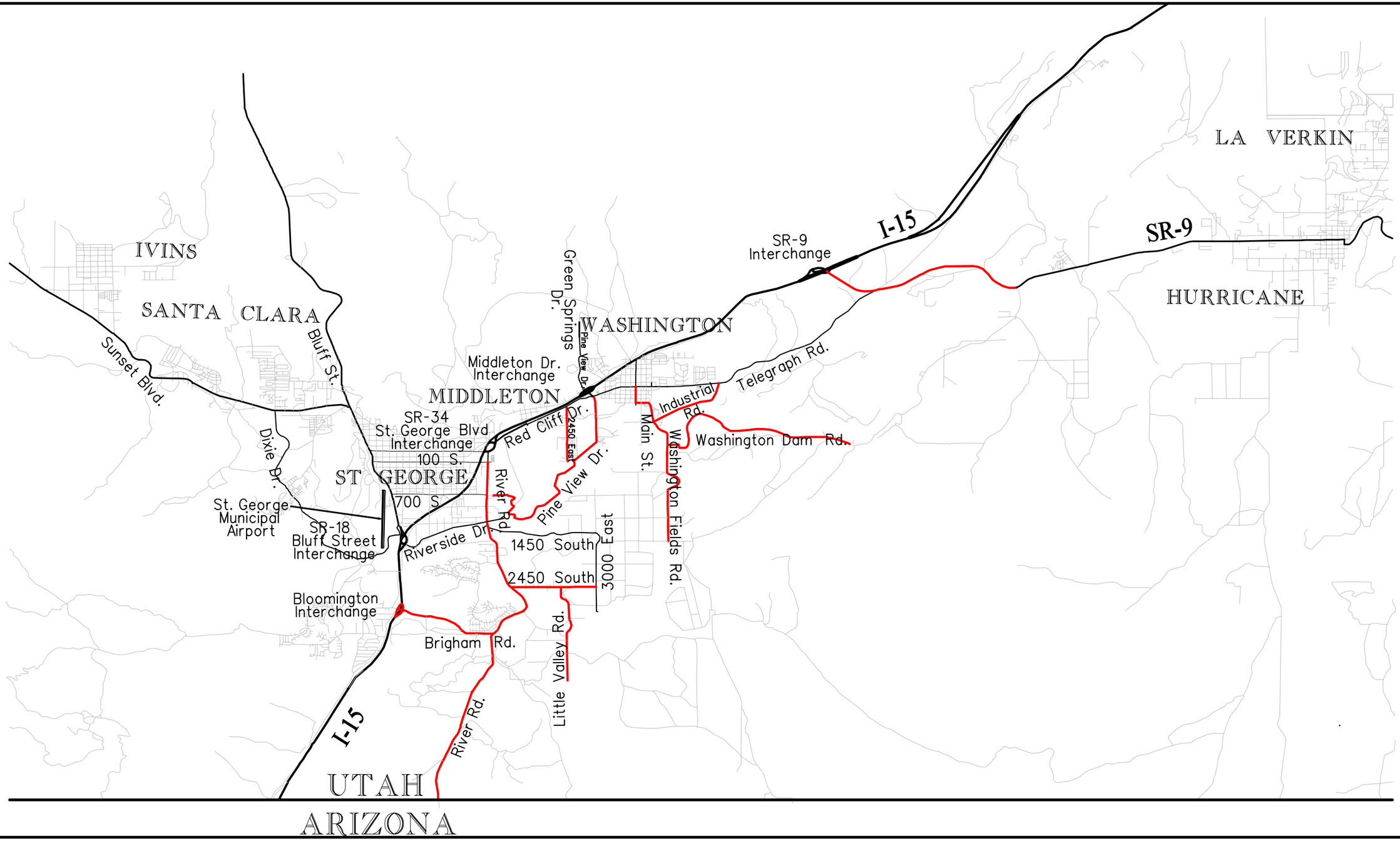

LEGEND

Congestion Improvements

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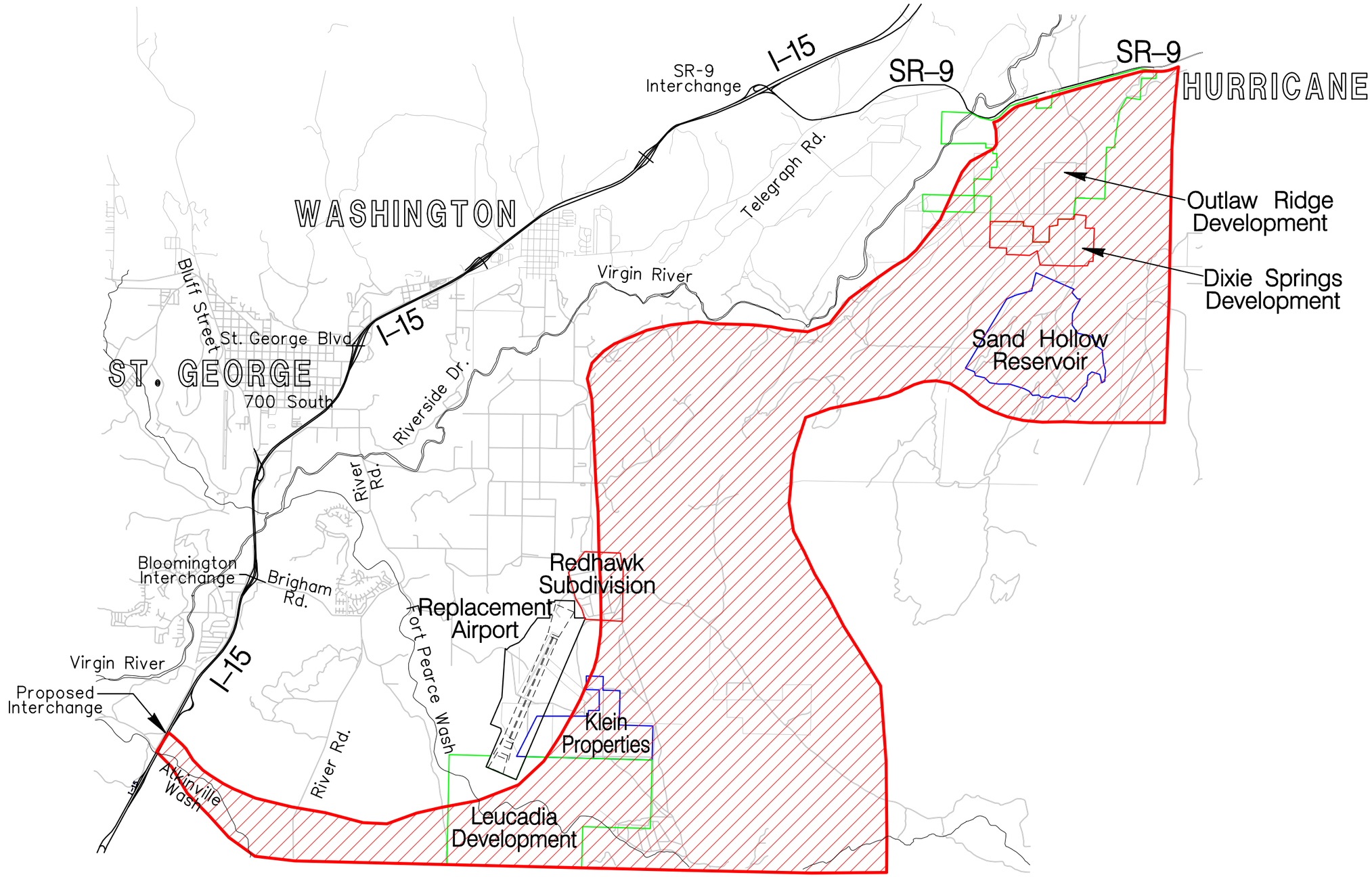
Figure 2-1

2030 REGIONAL AND LOCAL ROADWAY CONGESTION IMPROVEMENTS WITH THE SOUTHERN CORRIDOR

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
SALT LAKE CITY, UTAH



LEGEND

Study Area / Regional Alignment

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Figure 2-2

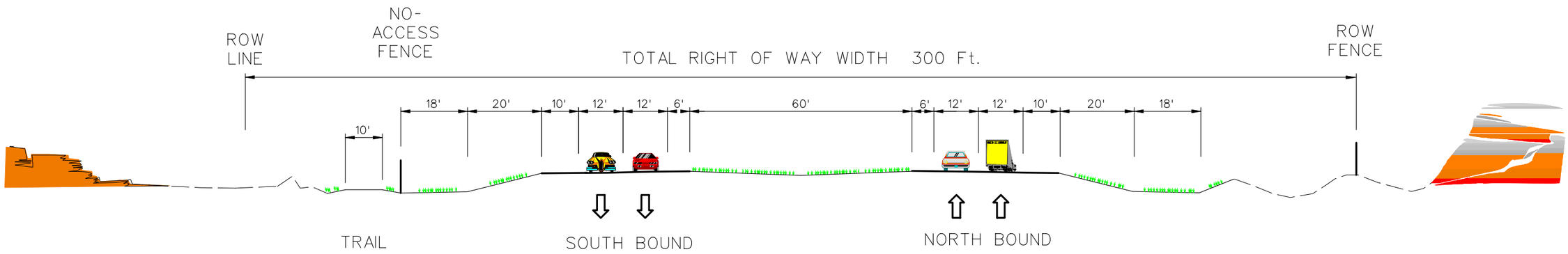
REGIONAL ALIGNMENT

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
SALT LAKE CITY, UTAH

SOUTHERN CORRIDOR

Design Speed 70 mph



TYPICAL MAINLINE SECTION WITH MULTI-PURPOSE TRAIL

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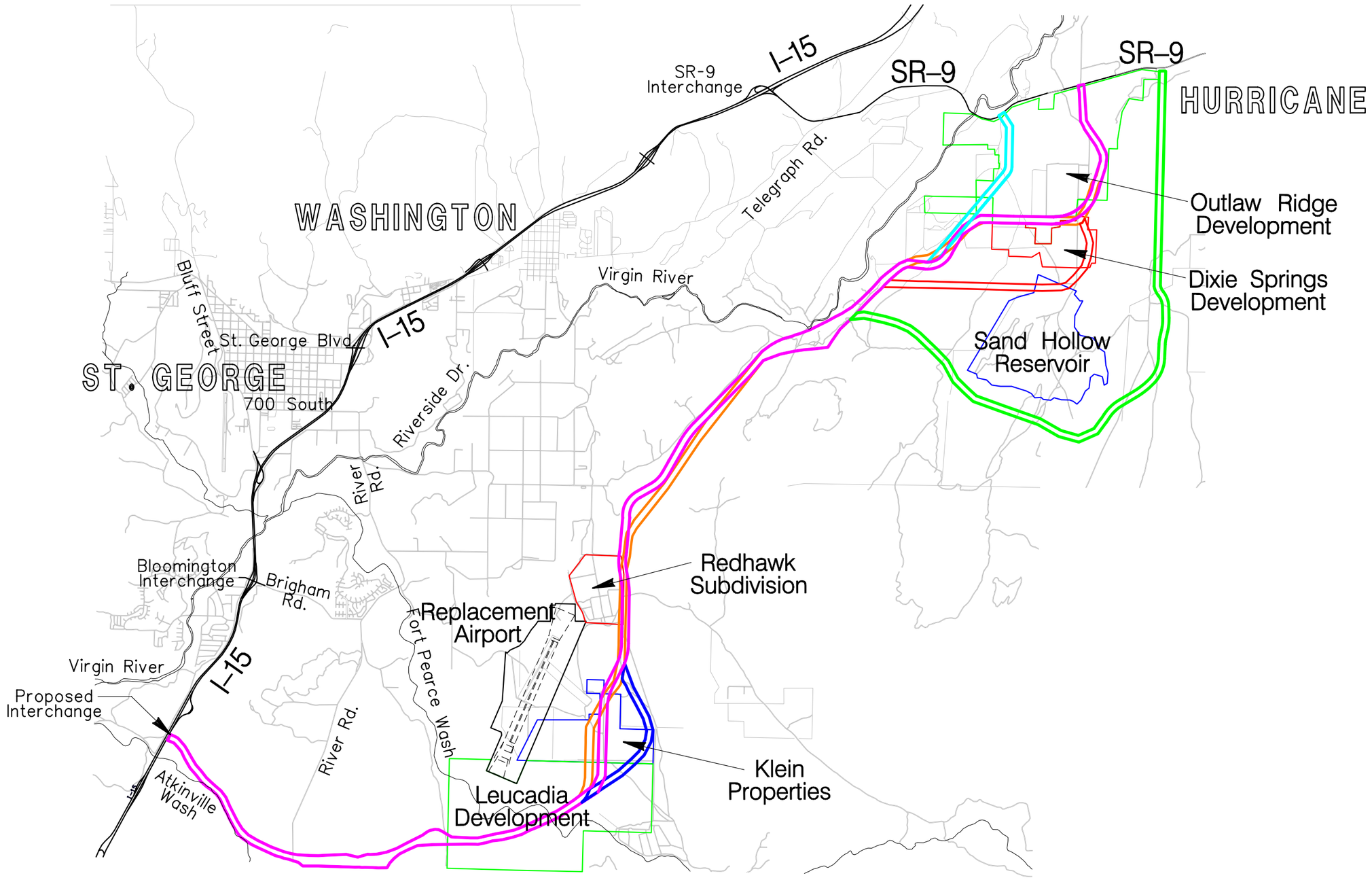
Figure 2-3

TYPICAL SECTION

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
SALT LAKE CITY, UTAH



LEGEND

- Modified A
- Alternative A
- Alternative B
- Alternative C
- Alternative D
- Alternative E

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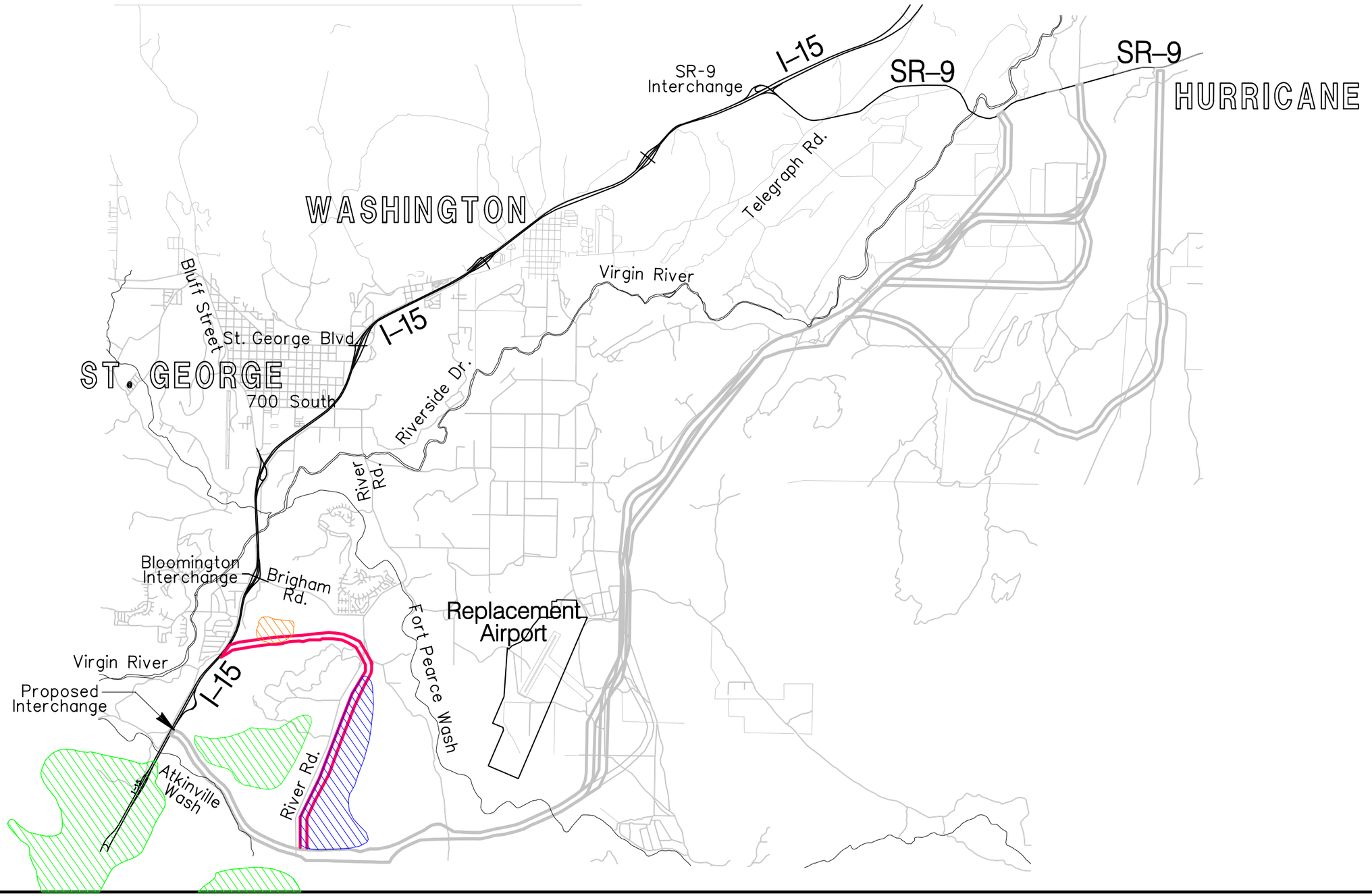
Figure 2-4

ALIGNMENT ALTERNATIVES EVALUATED

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
SALT LAKE CITY, UTAH



LEGEND

- Other Alternative
- Holmgren Milkvetch Habitat
- Proposed Industrial Development
- Planned/Existing Residential Development

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Figure 2-5

OTHER ALTERNATIVE CONSIDERED

Southern Corridor EIS
March 2003

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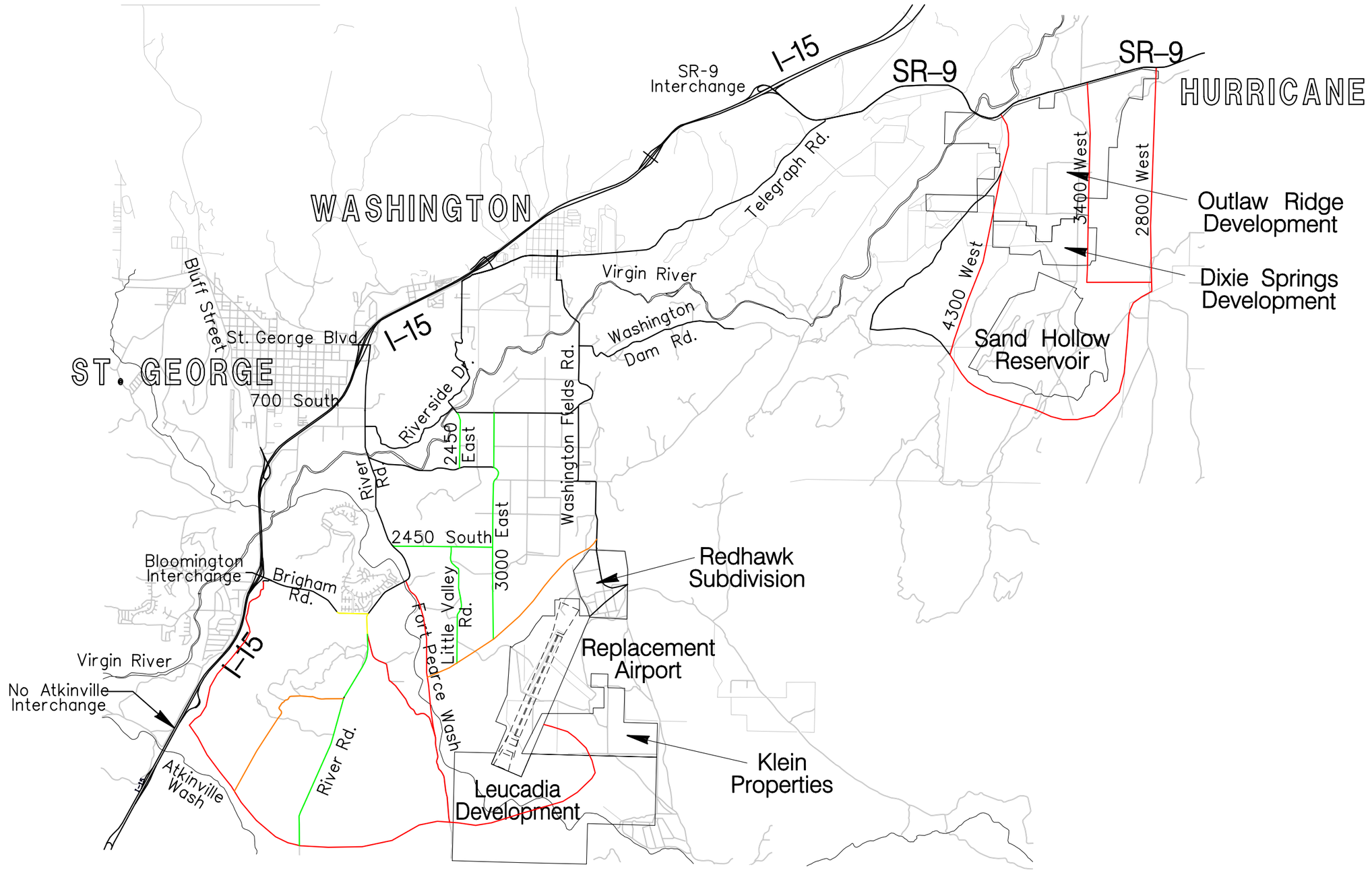

LEGEND

- 5 Lane Roadway (Expansion of Existing)
- 7 Lane Roadway (Expansion of Existing)
- 5 Lane (Proposed)
- 2 Lane (Proposed)

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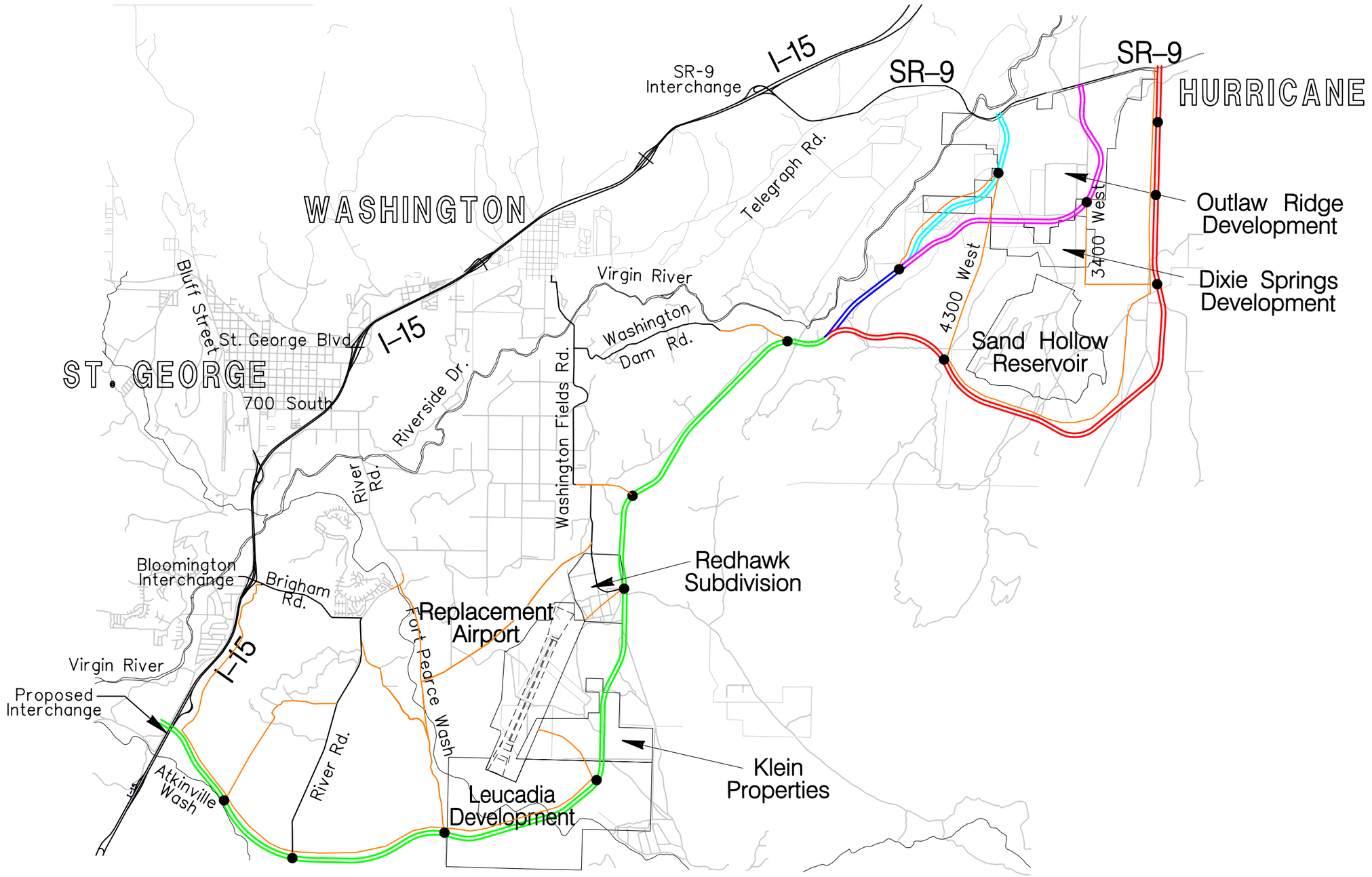
Figure 2-6

NO-BUILD ALTERNATIVE ROADWAY NETWORK

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
SALT LAKE CITY, UTAH



LEGEND

- All Alternatives
- 4300 and 3400 West Alternatives
- 4300 West Alternative
- 3400 West Alternative
- 2800 West Alternative
- Proposed Interchange*
- Proposed Minor Arterials

*Potential interchange locations are approximate and may vary depending on the final land development.

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Figure 2-7

BUILD ALTERNATIVES ROADWAY NETWORK

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
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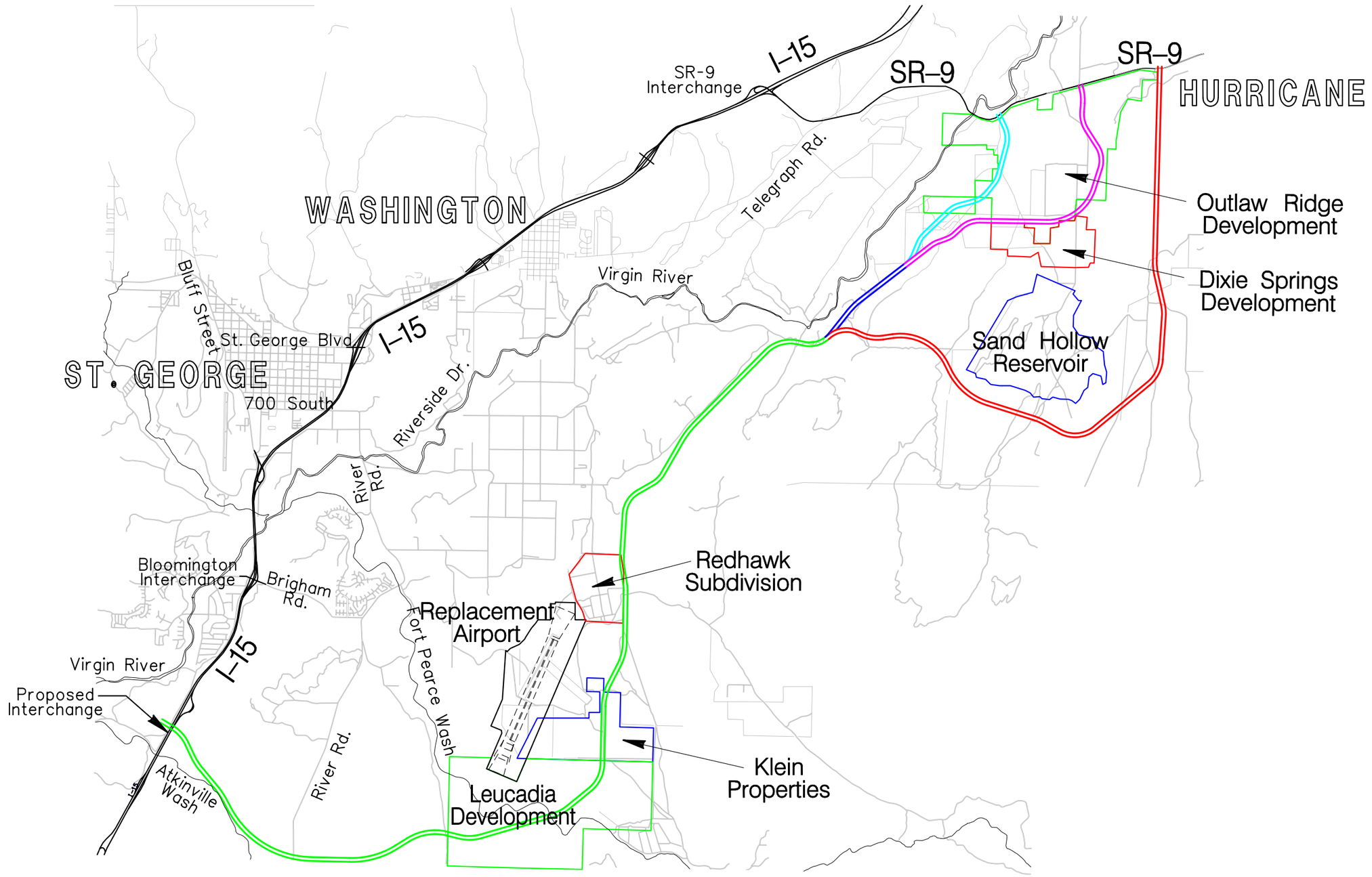

LEGEND

- All Alternatives
- 3400 and 4300 West Alternatives
- 4300 West Alternative
- 3400 West Alternative
- 2800 West Alternative

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Figure 2-8

SOUTHERN CORRIDOR 4300 WEST, 3400 WEST, AND 2800 WEST ALTERNATIVES

Southern Corridor EIS
March 2003

HDR Engineering, Inc.
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